

# SUBTERRA<sup>®</sup> GREEN

The **Subterra Green** is a field instrument for measurement and mapping soil organic carbon – as well as other soil qualities, such as bulk density and water content – from the surface down to a depth of 36 inches into the soil. The Subterra inserts a fiberoptic probe in steps into the soil recording soil spectra at each step. Visible and near infrared light is reflected from the soil and analyzed by spectrometers at the top of the probe. In addition, the Subterra measures the soil compactness by recording the force needed to insert the probe into the ground. The Subterra Green uses machine learning models, calibrated by laboratory measurements, to correlate the recorded data with the soil properties of interest.

## OPTICAL SPECIFICATIONS

- Quartz halogen light source.
- Two spectrometers for analysis of reflected light: One for visible light and the adjacent part of near infrared (400 – 1100 nm) and one for the extended near infrared (1100 – 2500 nm).
- An all-fiberoptic probe to conduct the light between the instrumentation above ground and the in-situ locations in the soil below ground.

## ELECTRICAL SPECIFICATIONS

- Two Li ion 36V, 13 Ah batteries provide power to the actuator and regulated 24V power to the other instrumentation.
- Load cell to measure probe insertion force up to 500 lb.
- Integrated GPS (Geode GNS3).
- All-day battery life.

## MECHANICAL SPECIFICATIONS

- Weight of the Subterra Green unit (with batteries, surface tablet, and other accessories attached): 138 lbs. (63 kg)
- Subterra Dimensions: 65" x 26.5" x 23" (165 cm x 67 cm x 59 cm)
- Soil Probe: Maximum insertion depth: 36" (91 cm); probe shaft: 0.50" (13 mm) diameter; probe tip: 0.54" (14 mm) diameter hardened stainless steel with sapphire window.
- Stepwise Probe Insertion: 1 cm, 2.5 cm, or 5 cm per step, or a user-programmable step pattern.
- Maximum Probe Insertion Force: Set in the software to 300 lbs. (136 kg); adjustable to as high as 500 lbs. (227 kg) (not recommended).

## Model-P Specifications

A tool for measurement of soil organic carbon



## DATA & CONTROL INFORMATION

- Instrument control and data collection are handled by a Surface Tablet computer running the Window operating system.
- A data summary is provided on the screen immediately after each probe insertion, showing spectra and insertion force as a function of depth.
- The user may download data (.h5 or .csv files) for subsequent stages of analysis and interpretation.
- The tablet may be connected to the internet for software updates from S4 Mobile Laboratories and for assistance with problems or with data analysis.

## CONSUMABLES & FIELD SITE IMPACT

- Uses no chemicals, fuel or fluids. The unit runs on batteries that may be recharged after each day's use from a standard electrical outlet (110 V in North America, 240 V elsewhere).
- Measurements are made by insertion of a fiberoptic probe into the soil; nothing is left in the soil, and the Subterra removes no soil from the ground.
- Consumable components include the soil probe and the white calibration blanks. The soil probe has a hardened stainless-steel tip and a very hard sapphire window, which may last for thousands of insertions, but the actual probe lifetime will depend on the soil type and condition and the pattern of usage. The calibration blanks have a thick layer of the Spectralon material, allowing them to be cleaned many times before replacement.

## SHIPPING CASE SPECIFICATIONS

- Provided with the Subterra Green. Designed for repeated use by the end user for shipping by commercial carrier to distant sites.
- Case weight: 154.5 lbs. (70 kg)
- Case dimensions: 76.2" x 30" x 32" (194 cm x 76 cm x 81 cm)